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ABSTRACT

One hundred six recent articles are abstracted that are relevant to research carried on in the Word Identification activity. The articles cover investigations on intersensory integration, response mediation, and facets of response learning. (Author)

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RESPONSE LEARNING, MEDIATION AND INTERSENSORY INTEGRATION: AN ANNOTATED BIBLIOGRAPHY

Gary Verna

ABSTRACT

One hundred-six recent articles are abstracted[1] that are relevant to work carried on in the Word Identification activity. The articles cover investigations on intersensory integration, response mediation, and facets of response learning.

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[1]With some editing by the author, abstracts are quoted from the articles.

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RESPONSE LEARNING, MEDIATION AND INTERSENSORY INTEGRATION: AN ANNOTATED BIBLIOGRAPHY

1. Amster, H., & Keppel, G. Letter-sequence habits in children. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 326-332.

The characteristics of letter associations in 7-year-old children, 10-year-old children, and college-age adults were compared. The study focuses on developmental changes in letter-to-letter habits, including the specific habits studied on the college-age adults by Underwood and Schulz (1960). With respect to strategies in responding, children showed greater evidence of repetitive strategies, e.g., repetition of a stimulus term, alphabetical responding etc., than adults; but the frequency of meaningful units, e.g., words and initialed abbreviations of institutions, increased with age. In addition, frequencies of specific letter responses for adults tended on the whole to conform more closely to the frequencies in the language than did the children's frequencies. There was also a clear developmental trend toward increased strength of primary with age.

2. Asher, J. J. Vision and audition in language learning. *Perceptual and Motor Skills*, 1964, 19, 255-300.

The primary purpose was to present data for the transfer of learning from one sensory modality to another, specifically the relationship between vision and audition. The parameter was a range of natural languages including Spanish, Japanese, Russian, Turkish, and Persian. The secondary purpose was to suggest some theoretical constructs which may account for the data, and the third purpose was to explore certain side issues such as pronunciation shock and the validity of predictors for paired-associate learning. There was positive transfer of large magnitude from vision to audition for Spanish, Japanese, Turkish, or Persian, but a small, negative transfer for Russian. There was positive transfer from audition to vision for Spanish, Japanese, and Russian, but transfer was neutral for Turkish and negative for Persian. The magnitude of the positive transfer was usually higher from vision to audition than audition to vision. Much of the transfer data seemed to be accounted for with a phonetic fit hypothesis and a central mediation hypothesis of sensory process. The first concept, that of phonetic fit, postulates that positive transfer will be a function of the congruent match between the spoken and written language. The greater the congruency, the higher the probability of positive transfer between sensory channels. The second concept, the central mediation hypothesis, suggests that the direction and amount of transfer is a function of data processing not at the sensory receptor level, but at some centralized location in the brain.

3. Battig, W. F., & Wu, R. D. Comparison of recall and anticipation paired-associate procedures within mixed aurally-presented lists. *Psychonomic Science*, 1965, 3, 233-234.

Superior performance within aurally-presented mixed paired-associate lists was demonstrated for pairs representing recall (Rec) as compared with standard anticipation (Ant) procedures, contrary to previous research. Facilitation on both Rec and Ant pairs resulted from their increased temporal separation, either by not mixing Rec with Ant pairs or by surrounding the temporally separated Rec pairs or S-terms by 15-sec. blank intervals.

4. Beery, J. W. Matching of auditory and visual stimuli by average and retarded readers. *Child Development*, 1967, 38, 827-833.

Fifteen children of normal intelligence with specific reading disability and an equal number of controls matched for IQ, sex, and age were compared with respect to their performance on 3 tasks: Birch and Belmont's test of auditory-visual integration, a longer version of the same test, and a third test which employed the same configurations but which interchanged the stimulus and response modalities of the original task. The performance of the dyslexic children was inferior to that of their controls on all 3 tasks. No differences could be demonstrated in the ability of these tasks to discriminate between the 2 groups. The findings are discussed in light of other research dealing with auditory-visual integration and appear to be consistent with the results of the other investigators.

5. Birch, H. G., & Belmont, L. Auditory-visual integration in normal and retarded readers. *American Journal of Orthopsychiatry*, 1964, 34, 852-861.

The relation of auditory-visual integration to reading retardation was studied in 200 children nine and ten years of age. One hundred and fifty were retarded readers and 50 were normal readers. The retarded readers were significantly less able to make judgments of auditory-visual equivalence than were the normal readers. Within the two groups of readers, those children with lower auditory-visual performance tended to have the lower reading scores. When children with low normal IQ were eleminated from consideration, the significant difference in auditory-visual test performance between the retarded and normal readers was sustained. The findings were interpreted to indicate that the development of auditory-visual integration has specific relevance to reading, although it is not the sole factor underlying reading incompetence.

6. Birch, H. G., & Belmont, L. Auditory-visual integration, intelligence and reading ability in school children. *Perceptual and Motor Skills*, 1965, 20, 295-305.

The developmental course of auditory-visual equivalence was studied in 220 elementary school children. It was found that improvement in auditory-visual integration was most rapid in the earliest school years and reached an asymptote by the fifth grade. The correlations obtained between IQ and auditory-visual integration suggested that the two features of functioning were associated but not synonymous. In contrast, the correlations between IQ and reading ability rose with age. These opposing age trends in correlations found between reading ability and auditory-visual equivalence and between reading ability and IQ are interpreted in terms of the possible attenuating effect introduced by the low age ceiling of the auditory visual test and the possibility that in acquiring reading skill primary perceptual factors are most important for initial acquisition but more general intellectual factors for later elaboration.

7. Birch, H. G., & Lefford, A. Intersensory development in children. *Society for Research in Child Development, Monograph No. 89*, 1963, 28(5), 1-48.

The relationships among visual, haptic, and kinesthetic sense modalities were explored for geometric form recognition. One hundred and forty-five pupils of a suburban public elementary school served as subjects. Their ages ranged from 5 to 11 years, and their median IQ was 115. The method utilized was a modification of the paired comparisons method. A standard stimulus presented to one sense modality was compared with variable stimuli in another sense modality.

8. Boroskin, A., & Lindley, R. H. Meaningfulness versus pronunceability in immediate memory and free recall. *Journal of Experimental Psychology*, 1970, 83(1), 182-184.

Meaningfulness and pronounceability were compared as predictors of immediate memory and free recall. For the items used in the present study, meaningfulness was a better predictor of performance than pronounceability. The discrepancy between the present results and previously reported results was attributed to better control in the present study of item form class and of scaled meaningfulness and pronounceability. Implications of the results are discussed.

9. Braud, W. G., Tolin, P., & Holborn, S. W. Pronunciability rating and learning of doubly homogeneous paired-associate lists. *Psychonomic Science*, 1966, 6(10), 457-458.

Forty Ss learned homogenous paired-associate lists consisting of 12 number-CVC trigram pairs equated for association value and familarity. Two groups of 10 Ss each learned lists having low PR (easy to pronounce) response terms; 2 groups learned lists having high PR (difficult to pronounce) response terms. High and low PR groups did not differ significantly either in terms of mean number of trials to reach criterion or mean total number of correct responses over 25 trials. Rank-order correlations indicated that PR predicted neither the length of the integrative stage nor the total number of correct associations for these CVC trigrams. Results were discussed in terms of list homogeneity with respect to PR and trigram form-class, and in terms of the particular items comprising the lists.

10. Bruce, D., & Crowley, J. J. Acoustic similarity effects on long-term memory for paired associates. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 430-433.

Does acoustic similarity between the left-hand members of two paired-associate (PA) lists impair long-term memory (LTM) in a proaction design? Under one treatment, the left-hand term of the two lists were acoustically similar (e.g., Young-Lung); under a second treatment, they were not acoustically similar. Either 10 min, 24 hr, or 1 week intervened between the end of List 2 learning and the recall test on List 2. Subsequent to the memory test on List 2, retention of List 1 was also assessed. Neither recall of List 2 nor memory for List 1 was substantially affected by the manipulation in acoustic similarity. For LTM following multitrial training on two full-scale PA lists, it is concluded that both proactive and retroactive inhibition attributable to acoustic similarity between the left-hand terms of the lists are negligible.

11. Buschke, H. Auditory and visual interaction in immediate memory. *Psychiatric Research*, 1962, 1, 229-237.

Simultaneous auditory and visual displays of different numbers were presented serially to 36 normal human subjects who were instructed to indicate their recognition of any repetitions in each series so that homo-modal and hetero-modal retrieval from immediate memory storage might be compared. Auditory input was retained best, repetitions in either modality were equally effective in retrieval, and retrieval of both modalities of input was proportional to their contribution to total retained input.

12. Calfee, R. C., Venezky, R. L., & Chapman, R. S. Pronunciation of synthetic words with predictable and unpredictable letter-sound correspondences. Technical Report No. 71, 1969, Wisconsin Research and Development Center for Cognitive Learning, Madison, Wisconsin.

A child learns to read by first learning to translate from visual symbols to sound. One part of this process is the formation of correspondences between letter patterns and the sounds for which they stand. Recent linguistic research has revealed more regularity in letter-sound correspondences than was previously thought. A major concern of the study reported here was to find the extent to which readers used such correspondences in pronouncing synthetic words, and how they pronounced synthetic words for which no such regular correspondences existed.

A list of synthetic words was prepared for testing the pronunciation of predictable patterns (final -e, c before e and i, and c before a, o, and u), unpredictable patterns (vowel digraph spellings such as ai, ou), and miscellaneous spellings (th, final -s). For the predictable patterns, the appropriate responses were taken to be the long form of the vowel for final -e patterns (rate, mete, bite, rote, cute), c pronounced /s/ before e and i (cell, city), and c pronounced /k/ before a, o, and u (cake, coke, cute). A 40-item list and 5 pretraining items, prepared on slides in capital letters, were presented to Ss in one of two random orders. Responses were recorded and transcribed by graduate students trained in phonetics. Participating in the study were third and sixth graders from two elementary schools, eleventh graders, and college students.

It was found that, to the extent that a child in third grade was identified as a good reader, he showed some mastery of predictable letter-sound correspondences. This mastery increased through high school, but the correlation with reading achievement decreased, presumably because this ability is only one of many necessary for skilled reading. Poor readers made more and "wilder" errors on predictable patterns and gave less consistent responses to unpredictable spellings.

13. Chang, J. J., & Shepard, R. N. Meaningfulness in classification learning with pronounceable trigrams. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 85-90.

Subjects learned to classify eight CVC trigrams into two equal subsets by a paired-associate method in which one response was associated with each of the four trigrams in one subset while a second response was associated with each of the four trigrams in the other subset. One such classification could be learned on the basis of a single letter in each trigram while a second classification required Ss to take account of all three. A third condition

was also included in which a different response was associated with each of the eight trigrams. Comparisons among these three conditions indicated that the tendency to respond to each trigram as a whole (rather than on the basis of its constituent letters) was not appreciably greater when the trigrams were eight meaningful words than when they were eight nonsense syllables.

14. Cofer, C. N. Learning of content and function words in nonsense syllable frames: A repetition and extension of Glanzer's experiment. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 198-202.

Glanzer has reported that in paired-associate learning response triplets containing function words bounded by two nonsense syllables are learned significantly more readily than similar triplets containing content words. This finding was replicated in Exp. I, but in experiments in which exposure intervals were lengthened and in which short words were substituted for long words used by Glanzer the effects of grammatical class on the learning of the triplets were not significant. Pronunciability of the triplets was found to be predictive of their learning.

15. Cramer, P. Functioning of implicit associative responses in mediated transfer. *Journal of Experimental Psychology*, 1969, 82(2), 301-309.

Using an A'-B, A-C paradigm, a 3 x 3 x 2 factorial experiment was designed that varied the strength of implicit associative responses (IARs), the degree of first-list learning, and the locus of mediation. The results from 18 independent groups of Ss (N = 16/group) indicated that transfer was a function of the interaction of these three variables. With increasing degrees of original learning, transfer became positive for the unidirectional paradigms, but remained negative for bidirectional paradigms. The results are interpreted as supporting three hypotheses: (a) presentation of a stimulus word results in the automatic elicitation of IARS of differing strengths in the associative hierarchy, any one of which may function to mediate transfer; (b) in a transfer task, such IAR elicitation occurs both during original list (OL) and test list (TL) learning; (c) under certain conditions, if the elicitation of such IARs produces interference, S is able to inhibit their occurrence.

16. Dallett, K. M. Implicit mediators in paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 209-214.

On the first trial of paired-associate learning, when the stimulus trigram appeared and before the response word was shown, an attempt was made to alter S's associative response to the

stimulus trigrams by presenting a word which was (a) an associate of the trigram according to free-association norms, and (b) judged by E to be either relevant or irrelevant to the response which S was to learn. If a relevant association was primed in this way, S learned faster than if an irrelevant association was primed. An unprimed Control group did not differ from the Relevant group: together with other evidence, this was taken to mean that the relevant mediating associations were readily available without priming. Priming with the response word itself led to performance equivalent to that of the Controls. Another group of Ss gave an associate of their own on the first trial, and were retarded in subsequent learning relative to the Control group. Within this Association group, however, items which elicited relevant associations were easier to learn than items which happened to elicit irrelevant association. The results support the associative probability hypothesis of Underwood and Schulz.

17. Dallett, K. M., & D'Andrea, L. Mediation instructions versus unlearning instructions in the A-B, A-C paradigm. *Journal of Experimental Psychology*, 1965, 69(5), 460-466.

In three experiments, Ss learned the 1st list of an A-B, A-C paradigm, and were then differently instructed for List 2 learning. Mediation Ss were told to use the List 1 responses as aids to List 2 learning, while Unlearning Ss were told to unlearn List 1 responses in order that they not interfere with List 2 learning. The differential instructions did not affect the rate of List 2 learning, but did affect the relative difficulties of List 2 items. The Mediation Ss were slightly better in subsequent List 1 recall, and reported many more instances of interlist mediation than did the Unlearning Ss.

18. Davidson, R. E., & Adams, J. F. Verbal and imagery processes in children's paired-associate learning. *Journal of Experimental Child Psychology*, 1970, 9, 429-435.

Experimental operations that typify studies in syntactic mediation were used in a study of 64 second-grade children split into four independent groups. Syntactic and imagery mediators were imposed on the learners. Both kinds of mediators were shown to facilitate the learning of noun pairs, but a minimal language cue (prepositional connective) was more effective than imagery. The results offer support for the hypothesis that verbalization is the preferred symbolic process in young children. In particular a recognition procedure ruled out a response availability hypothesis which had been held to account for the superiority of syntactic mediators.

19. Downing, J. The perception of linguistic structure in learning to read. *British Journal of Psychology*, 1969, 39, 267-271.

The first ad hoc investigations of i.t.a. have established its practical effects in the early stages of learning to read. However, further work is needed to determine exactly how psychologically i.t.a. produces the observed improvements in reading and spelling. The theory is proposed that i.t.a.'s clarification of linguistic structure facilitates perception of phonemes, spoken-words, graphemes and written words as individual units, and that this is an important factor in the superior achievements of i.t.a. taught pupils. It is argued that, contrary to Vernon's view, this perceptual facilitation should also lead to improvements in 'the process of synthesis' which she has described.

20. Earhard, B., & Mandler, G. Mediated associations: Paradigms, controls, and mechanisms. *Canadian Journal of Psychology*, 1965, 19(4), 346-378.

The experimental and control paradigms used in conventional demonstrations of verbal mediated associations are examined in detail. In Part I it is argued that the observed differences in mediation paradigms, when mediation is demonstrated through laboratory-established associations, cannot be attributed unequivocally to mediation mechanisms. Paradigm and control conditions were found to differ with respect to non-mediational factors such as forgetting and interference which tend to produce effects similar to those predicted from the mediation model. In Part II methods for overcoming these deficiencies are discussed and evidence for the operation of mediational rules or conceptual mediation is presented. In Part III the conventional mediation model is evaluated and a theoretical resolution is suggested.

21. Ekstrand, B. R. A note on measuring response learning during paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 344-347.

An analysis of a technique commonly used to measure the relative lengths of the two stages of paired-associate learning (response learning and associative learning) was presented. This technique involves using the "first given" (FG) as a measure of the duration of the response-learning stage. FG is the number of trials before S gives a response anywhere in the list, disregarding the appropriateness of the stimulus to which it is given. On the basis of studies existing in the verbal-learning literature, it was shown that FG overestimates the time required for response learning, probably because Ss wait to give a response until a certain level of confidence about the correctness of the response is reached.

This level was termed the confidence threshold. The amount of interference present in the learning situation is likely to be one of the determinants of the time required to reach the threshold. In order to measure accurately the response-learning stage, a procedure similar to that of Underwood et al. (1959) may be followed: PA learning is stopped at various points and response learning is measured by free recall with a "paced" procedure. A second alternative is the use of free learning to study the effects of variables on the response-learning stages of PA learning.

22. Epstein, W. The influence of syntactical structure on learning. *American Journal of Psychology*, 1961, 74, 80-85.

An experiment was performed which showed that syntactical structure facilitates verbal learning apart from the contributions of meaningfulness, familarity, and sequential probability. Possible explanations of this effect were discussed.

23. Epstein, W. A further study of the influence of syntactical structure on learning. *American Journal of Psychology*, 1962, 75, 121-126.

Two experiments dealing with the influence of syntactical structure on learning were reported. In Experiment I an earlier study was repeated with new material. The results confirmed the earlier conclusion that syntactical structure facilitates learning separately from meaningfulness, familiarity, and transitional dependency.

Experiment II was an investigation of the effects of structure in serial learning. No difference was obtained between structured material and matched, unstructured material.

24. Epstein, W., & Platt, J. R. Free recall of paired associates as a function of meaningfulness. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 269-273.

The free recall of a list containing Lo m'- Lo m', Lo m'-Hi m', Hi m'-Lo m', and Hi m'-Hi m' pairs was investigated. The aims of the research were to examine the generality of the relationship between meaningfulness and acquisition, and to examine the possibility that the greater effects of response-M usually obtained can be attributed to the greater emphasis on response-recall under the conditions of the method of anticipation. The conditions of free recall of pairs place equal emphasis on stimulus and response recall. Under these conditions it was expected that the greater effects of variations in response-M should be eliminated.

Each type of pair was found to differ significantly from the remaining three pairs. The pairs were found to rank in the following order of increasing difficulty: Hi-Hi, Hi-Lo, Lo-Hi, Lo-Lo. These results as well as the results of additional analysis were considered as supporting the present interpretation of the effects of response-M on anticipatory paired-associate learning. The results also indicate that when both stimuli and responses have to be recalled, stimulus-M is more influential than response-M in determining paired-associate learning.

25. Gallagher, J. W. Paired associate learning in children as a function of type of syntactic relationship and associative relationship. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 491-495.

At each of three grade levels one group of Ss received a list of 12 syntagmatic word pairs, while another group of Ss received a list of 12 paradigmatic word pairs. Each list consisted of bidirectional, unidirectional, and nonassociated pairs. Free-association strengths for the unidirectional and bidirectional pairs were equated within and between grade levels.

The syntagmatic pairs were learned faster than the paradigmatic pairs. Comparisons within each grade level yielded similar results. The facilitating effect of the syntagmatic relationship was found with the unidirectional and nonassociated pairs, but not with the bidirectional pairs. Overall bidirectional and unidirectional pairs were learned faster than nonassociated pairs and bidirectional pairs were learned faster than unidirectional pairs. The latter result was true for Grades 8 and 12, but in Grade 4 no difference was found between the bidirectional and nonassociated pairs.

26. Gibson, E. J., Bishop, C. H., Schiff, W., & Smith, J. Comparison of meaningfulness and pronunciability as grouping principles in the perception and retention of verbal material. *Journal of Experimental Psychology*, 1964, 67(2), 173-182.

Thresholds of visual perception and 2 measures of retention were obtained for trigrams varying in pronunciability and meaningfulness (semantic reference of the kind found in well-known initials), and for control items. The 3 types of trigrams contained the same letters rearranged anagram-wise. Perceptual thresholds were lowest for pronounceable items, and next lowest for meaningful ones. On the other hand retention, measured by both recognition and free recall, was best for the meaningful items and second best for pronunceable ones. Pronunciability was inferred to be the better grouping principle for reading or coding to speech units. Meaningfulness was inferred to have facilitated retention more than pronunciability by providing a category for grouping the initial items, thus aiding retrieval.

27. Gibson, E. J., Pick, A., Osser, H., & Hammond, M. The role of grapheme-phoneme correspondence in the perception of words. *American Journal of Psychology*, 1962, 75, 554-570.

The hypothesis has been proposed that the proper unit of the reading process is neither the single letter nor the whole word but a higher-order invariant derived from grapheme-phoneme correspondences. Rules can be drawn up for predicting spelling from sound if temporal patterning of 'clusters' is taken into account. It was proposed that the skilled reader has learned to perceive as units the letter-patterns conforming to these rules and that such patterns have, therefore, an advantage in reading.

Several experiments were performed to test this hypothesis. Pseudo-words conforming to rules of spelling-to-sound correlation were compared with ones of low correlation under conditions of tachistoscopic viewing.

In the first experiment, it was found that the Ss reproduce pseudo-words of high correlation more accurately than ones matched for summed letter-frequency, but of low correlation.

In a second experiment, comparable results were obtained when the Ss were not asked to reproduce a word, but performed perceptual matching of the word exposed tachistoscopically with a member of a multiple-choice list. It was concluded that the perceptual process has been facilitated in skilled readers for units discovered during long exposures to the grapheme-phoneme correspondences of the English language.

28. Gorman, A. M. Recognition memory for nouns as a function of abstractness and frequency. *Journal of Experimental Psychology*, 1961, 61(1), 23-29.

An operational definition of abstractness in nouns was constructed by using the human descriminative response to identify two points on a scale of abstractness. This scale, consisting of 490 "abstract" and 571 "concrete" nouns, was found to have adequate reliability. When the scale was manipulated as an independent variable, the effect of abstractness on short-term recognition memory was highly significant, "abstract" nouns being less well remembered than "concrete" nouns. Frequency was found to be a pertinent variable, independent of abstractness, very frequent nouns being less well remembered than somewhat rarer nouns.

29. Goss, A. E. Verbal mediation. *Psychological Record*, 1964, 14, 363-382.

The primary objective was to consider issues and techniques of explication of verbal mediating responses in general and in concept attainment in particular. The issues considered were conditions of the introduction of verbal mediating responses as components of post factum explanations, the analytical significance of verbal mediating responses, the locus and dimensions of verbal mediating responses and stimuli, and emphases in treating them. Techniques of explication of occurrences and consequences of verbal mediating responses and stimuli were classified as independent pre- or post-acquisiton assessments of recognition and association responses to stimuli, verbal pretraining, and correlated observation. Methods and findings of two experiments were used to illustrate some more specific techniques.

30. Goulet, L. R. Verbal learning in children: Implications for developmental research. *Psychological Bulletin*, 1968, 69(5), 359-376.

Current research in verbal learning is reviewed in terms of its implications for developmental research. Suggestions are provided which relate to the methodology of research incorporating age as a treatment variable in addition to highlighting the analytic utility of verbal learning paradigms in the study of developmental learning processes. The similarities of theory and data relating to nonverbal tasks (e.g., probability-learning, transposition, reversal-shift, and discrimination-learning paradigms) and to theory concerning the interaction of verbal learning and development are also discussed. (See also as bibliography for other relevant articles).

31. Haber, R. N. Effects of coding strategy on perceptual memory. *Journal of Experimental Psychology*, 1964, 68(4), 357-362.

Thirty-seven Ss were taught 1 of 2 strategies to encode and rehearse orally briefly presented multidimensional stimuli. Analyses were directed at separating the effects on accuracy of encoding processes and of retention processes. Regarding the former, the 2 strategies differed on the speed of encoding and on the accuracy of encoding. Further, stimuli encoded slowly were more likely to contain errors, independent of retention processes. Regarding these latter processes, the strategies differed on several types of interference responses during rehearsal (retention), responses that produced errors during rehearsal, independent of errors made during encoding. These results supported hypotheses about speed of encoding, and interference during retention, and showed how these effects could account for differences between the coding strategies.

32. Hall, R. F., & Wenderoth, P. M. Instruction induced strategies in paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1970, 9, 308-310.

An efficient stratagem which may be used by Ss in two-response PA learning is that in which Ss learn only the stimuli associated with one of the two responses. Groups of 30 Ss were instructed to use this stratagem (Group S), not to use it (Group N), or were not instructed either way (Group C). Performance of the groups was predicted to be in the order S, C, N in terms of rate of learning. Variances were predicted to be in the order C, N, S, with C the largest. Results were as predicted.

33. Hintzman, D. L. Articulatory coding in short-term memory. *Journal of Verbal Learning and Verbal Behavior*, 1967, 6, 312-316.

Confusion errors in short-term memory for visually-presented nonsense syllables were analyzed to determine the influence of two articulatory features of consonants: voicing and place of articulation. Both were found to contribute to confusions. Results are interpreted as consistent with a hypothesis of mediation by kinesthetic cues arising from subvocal rehearsal, and inconsistent with a hypothesis of mediation by an auditory image.

34. Hohn, R. L., & Martin, C. J. Mediational styles: An individual difference variable in children's learning ability. *Psychonomic Science*, 1970, 18(6), 348-349.

A mediational production task was developed whereby Ss' reported mediators to a PA list were scaled along a dimension of mediational complexity. Three groups of 5th-grade children were identified: complex mediational producers, simple mediational producers, and variable producers. Each group then learned another PA list. In addition, Ss in each group were supplied with complex mediators, simple mediators, or no mediators. The results indicated that complex and variable producers learned at significantly faster rates than did simple producers. Regardless of mediational style, complex E-supplied mediators facilitated learning.

35. Hopkins, R. H. Response learning in paired-associate recognition tasks. *Journal of Verbal Learning and Verbal Behavior*, 1970, 9, 287-294.

The Ss learned a 12-item paired-associate list with 2-digit numbers as stimuli and dissyllable response terms. Three types of test-trial procedure were used, two recognition tasks not requiring verbalization of the response member and the usual response-production task. Independent groups of Ss received

either 1, 2, 4, 8, or 16 study-test sequences before being interrupted, without warning, for the measurement of response availability by paced, free recall. Response availability was different for the two recognition procedures, though considerable response learning was observed in each of the three tasks. The response terms did become available for recall at a faster rate in the response-production task than with either recognition procedure.

36. Hopkins, R. H., & Schulz, R. W. Meaningfulness in paired-associate recognition learning. *Journal of Experimental Psychology*, 1969, 79(3), 533-539.

Nine independent groups of 22 Ss each learned a paired-associate (PA) list consisting of either high-, medium-, or low-meaningfulness (M) stimulus (S_1) members paired with either high-, medium-, or low-M response (S_2) members. The lists were presented aurally to groups of Ss and learning was by the method of PA recognition, in which the need for response learning is eliminated. The results were similar for mean total numbers of correct responses, areas under the isomnemonic curves, and a measure of trial-to-trial shifts in accuracy of performance: performance was directly related to both S_1 and S_2 M, and variations in S_1 M had a greater effect on performance than comparable variations in S_2 M. The latter result, it should be noted, contrasts dramatically with the findings obtained in the "standard" PA situation where the effects of S_2 M are greater than those of S_1 M. The discussion focuses on this contrast in results in relation to the two-phase conception of the acquisition of paired associates.

37. Horowitz, L. M., & Larsen, S. R. Response interference in paired-associate learning. *Journal of Experimental Psychology*, 1963, 65(3), 225-232.

Response familiarization can facilitate or hinder subsequent paired-associate (PA) learning, but the critical task-variables have not been known. The present study suggests that items learned during familiarization may compete with the responses of the PA task. 80 Ss participated in a familiarization task and then learned English-Japanese word pairs by the PA or associative matching method. (In associative matching S does not produce the responses, so extralist responses cannot intrude.) Group I was familiarized with only relevant responses; Group II, with irrelevant but similar responses; Group III, with irrelevant, dissimilar responses; and Group IV had no familiarization. In associative matching the performance of Groups I and II was superior to that of Groups III and IV ($p < .001$). In PA learning the performance of Group I was facilitated while that of Group II was hindered ($p < .05$).

38. Horton, D. L. The effects of meaningfulness, awareness, and type of design in verbal mediation. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 187-194.

Two three-stage mediation paradigms, simple chaining and response equivalence, were used to investigate the effects of meaningfulness of the common element, type of design, and learning ability of the Ss on mediate association and awareness of the mediational relations.

The results indicated that all of the experimental variables (except paradigm) were related to awareness and that variations in meaningfulness, type of design, and awareness were also related to the mediation effect. The results were discussed in terms of the relative independence of these variables in mediation and the issue of learning without awareness.

39. Hunt, R. G. Meaningfulness and articulation of stimulus and response in paired-associate learning and stimulus recall. *Journal of Experimental Psychology*, 1959, 57(4), 262-267.

Eighty Ss learned lists of paired associates in which the stimulus and response terms varied in meaningfulness (m). Four main experimental conditions were employed (High-High, High-Low, Low-High, and Low-Low). In addition half of the Ss in each condition articulated the stimulus word during learning while the other half did not.

Each S learned by the anticipation method with correction to a criterion of two successive errorless anticipations. Immediately after the acquisition trials Ss were given a "backward" recall test.

The main results were:

1. Variations in response meaningfulness produced a significant effect upon acquisition. Stimulus meaningfulness and articulation produced no significant effects.
2. Stimulus meaningfulness produced significantly greater stimulus recall, and the effect of response meaningfulness on stimulus recall approached significance. Stimulus articulation had no significant effect upon stimulus recall.
3. Learning curves for each of the four main experimental conditions were negatively accelerated and conformed to the hierarchy of effects predicted by Noble and McNeely.

It is concluded that the results of the present experiment generally support an S-R motor patterning view of paired-associate learning.

40. Jensen, A. R., & Rohwer, W. D., Jr. Syntactical mediation of serial and paired-associate learning as a function of age. *Child Development*, 1965, 36, 601-608.

Groups of 20 Ss at each of seven age levels from 5 to 17 years of age, matched on IQ and socioeconomic background, were compared on serial and paired-associate (PA) learning. Half the Ss learned under instructions to use syntactical verbal mediators, and half had no mediation instructions. The results showed that PA and serial learning interact differently with age and with mediation instructions. Speed of serial learning was little affected by mediation and beyond the age of eight was scarcely correlated with age under either condition of instructions. PA learning, on the other hand, was markedly facilitated by mediation instructions, particularly in the age range from 7 to 13, and PA learning ability was strikingly correlated with age when Ss were given no mediation instructions.

41. Johnson, G. J., & Penney, R. K. The effect of mixed vs. unmixed list designs in paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 234-239.

Previous investigators concluded that for the study of transfer effects mixed and unmixed list designs could be used interchangeably. The present study investigated performance on subsets of strongly and weakly associated pairs within a single list under two conditions: (a) when the pairs were combined with others of a similar associative strength; and (b) when they were mixed with other pairs having a different associative strength. Sixty Ss learned one of three lists of two-syllable adjectives. The strong unmixed-association list (UAL) contained 12 pairs of high associative strength. The weak UAL consisted of an equal number of weakly associated pairs. The mixed association list (MAL) was constructed of six items from each of the two UAL controls. Performance on the subset of strongly associated test pairs (items common to MAL and UAL) was better under the UAL condition, while performance on the subset of weakly associated test pairs was better under the MAL condition.

42. Johnson, R. C., & Fehmi, L. G. Aural-oral and written word frequency as related to rate of learning stimulus material. *Journal of General Psychology*, 1963, 69, 125-129.

Thirty Ss were tested on paired associate learning of three groups of response words; low frequency homophones (e.g., chute), low frequency nonhomophones, (e.g., hobble), and words matched in written frequency to both members of the homophone pair (e.g., the frequency of chute-shoot equals that of queen) from which the low frequency homophone was drawn. Homophones of low written and presumably high aural-oral frequency were learned no more rapidly than nonhomophones matched in written frequency. Both groups of low frequency words were learned significantly more slowly than words high in written frequency.

43. Jones, B., & Connolly, K. Memory effects in cross-modal matching. *British Journal of Psychology*, 1970, 61, 267-270.

Predictions based on the model advanced by Connolly and Jones (1970) regarding the storage systems involved in cross-modality matching tasks were examined. Adult subjects made intra-modal and cross-modal matches to a range of standard stimuli under three conditions: zero delay between presentation of standard and subject producing his match, interpolation of 10-sec. unfilled interval and interpolation of 10-sec. filled interval. The results confirmed previous findings about the properties of visual and kinaesthetic storage systems and their relation to central processing capacity. The hypothesis that translation takes place before storage in cross-modality matching tasks was also confirmed.

44. Kahn, D., & Birch, H. G. Development of auditory-visual integration and reading achievement. *Perceptual and Motor Skills*, 1968, 27, 459-468.

The interrelationships among auditory-visual integrative competence, IQ, and type of reading task were studied in 350 elementary school age boys from Grades 2 through 6. Visual and auditory discrimination skills, auditory rote memory, and the application of verbal labels to the physical stimuli were examined as possible mediators of the relation of auditory-visual integration to reading. It was found that (a) auditory-visual integrative competence and reading achievement were positively associated at all grade levels; (b) when the effects of IQ were partialled out auditory-visual integration continued to be related to reading skill especially Word Knowledge; and (c) none of the variables postulated as mediators satisfactorily accounted for individual differences in auditory-visual integrative performance. The data are interpreted within a framework which attempts to resolve apparent differences among studies previously reported. Special consideration is given to the differential effects of partialling IQ on the relationship of auditory-visual competence to different aspects of the reading task and to the relative effectiveness of using verbal labels and other strategies for making auditory-visual integrative judgments.

45. Kanungo, R. N. Learning of content, function, and nonsense words: An extension of Glanzer's experiment. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 262-265.

Two experiments, using a mixed-list design, assessed the implications of Glanzer's (1962) "Unit" analysis and the grapnel interpretation of associative learning. The experiments compared the associative learning of content, function, and nonsense words. In Exp. I, the words were learned when they appeared alone either

as stimuli or as responses in the paired-associate lists. In Exp. II, they were learned when presented in nonsense-syllable frames. In Exp. I the content words were learned better than both the function and the nonsense words. The learning of the function words was not different from that of the nonsense words. In Exp. II, the superiority in the learning of the content words disappeared, but the function words gained superiority over the nonsense words. The results are consistent with Glanzer's unit analysis and reveal the inadequacy of the grapnel model.

46. Kellas, G., & Butterfield, E. C. The interaction of pronunciability and response pretraining on the paired-associate performance of third-grade children. *Journal of Experimental Child Psychology*, 1970, 9, 265-271.

Following relevant, irrelevant, or no pretraining with the response terms of a paired-associate (PA) task, third-grade children were compared on PA performance. The response terms represented three levels of rated pronunciability within lists. Analysis of free learning indicated that performance increased as rated pronunciability increased. Analysis of PA performance revealed a facilitation due to relevant pretraining which increased as ease of pronunciability decreased. Examination of the types of errors committed during PA learning related the beneficial effect of relevant pretraining to a greater availability of the response terms for recall.

47. Kiess, H. O., & Montague, W. E. Natural language mediators in paired associate learning. *Psychonomic Science*, 1965, 3, 549-550.

Subjects learned paired CVCs using a modified study-test method. After presentation of pairs, two tests were given, where the second questioned about any natural language mediators (NLMs) Ss used to learn pairs. NLMs played an important role in learning correct responses. In addition, after the first correct recall items learned using NLMs were more often correct on later trials than those without NLMs.

48. King, D. J., & Forrester, W. E. The influence of semantic and acoustic similarity on retention of short sentences. *Psychonomic Science*, 1970, 20(4), 222-223.

Short sentences were used as the learning material in retroactive-interference (RI) and proactive-interference (PI) designs. The relative influence of acoustically and semantically similar interfering sentences in the two designs was studied. Significant PI but no significant RI effect was found. Both acoustically and semantically similar material interfered with retention, with the latter having a more powerful influence.

49. Laughery, K. R., & Pinkus, A. L. Short-term memory: Effects of acoustic similarity, presentation rate and presentation mode. *Psychonomic Science*, 1966, 6(6), 285-286.

The effects of four variables on short-term memory were studied: Presentation Rate (20, 60 or 180 items/min.), Presentation Mode (visual or auditory), Acoustic Similarity (High, BCDEGPTVZ or Low, HJLOQRWXY), and Length of Sequence (6 or 8 items). Performance varied inversely with the length of Sequence and Acoustic Similarity and directly with Presentation Rate. A significant Presentation Rate by Presentation Mode interaction was explained on the basis of less available time for rehearsal at the fast presentation rate due to the time required for the implicit translation from visual input to the storage of auditory cues.

50. Lindley, R. H. Words and pronunciation as coding aids. *Psychonomic Science*, 1966, 6(8), 395-396.

In Experiment I after an initial presentation of 1 or 2 to-be-recalled trigrams, E either spelled the items, pronounced them, or said related words. Pronunciation did not facilitate recall, whereas the related words did. Experiment II showed that the failure to find facilitatory effects of pronunciation in Experiment I was due to whether E or S did the spelling and pronuncing.

51. London, I. D. Research on sensory interaction in the Soviet Union. *Psychological Bulletin*, 1954, 51(6), 531-568.

Soviet research on sensory interaction has amassed over the past 24 years a fund of data that, in spite of a deserved skepticism, cannot but strike one for its persistent consistency and "logical," though novel, character. This research appears to demonstrate that all modalities undergo various modifications of sensory response on appropriate application of an accessory stimulus and that, where the primary stimulus is visual, the resulting modifications conform to striking patterns.

52. McCullers, J. C. Type of associative interference as a factor in verbal paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1965, 4, 12-16.

Sixth-grade children served as Ss in an investigation of the effects of various types of interference on performance in a verbal paired-associate task. Four types of competing associative connections initially present in the task were studied; these were (a) an interstimulus item connection, (b) an inter-response item

connection, and (c) two inter-word-pair S-R connections, one existing between the stimulus item of a weakly associated S-R pair and the response item of a strongly associated pair, and one existing between strong-pair S and weak-pair R. When compared with noncompetition controls, each of the four types of associative interference was found to have an over-all effect of impairing performance. The numbers and types of errors, however, were found to vary with the specific type of interference.

53. McGehee, N. E., & Schulz, R. W. Mediation in paired-associate learning. *Journal of Experimental Psychology*, 1961, 62(6), 565-570.

Two experiments were conducted to determine, among other things, how language habits inferred from free-association norms might mediate the learning of verbal paired associates in the Russell and Storms' (1955) situation. Their general procedure was replicated except that independent random groups and homogeneous lists as well as Ss of both sexes were used. The interlist relationship between the stimulus syllables and response words of the first and test lists were appropriately varied to define the various conditions under which the 216 Ss of the present experiments learned the 10-item lists on a memory drum at a 2:2-sec. rate.

From the results it was concluded that: (a) The response-recall phase of test-list acquisition is not facilitated in the mediated condition. (b) Mediated interference can be produced with the Russell and Storms' (1955) materials. (c) Under the mediated condition, the associative phase of test-list acquisition is facilitated via the specific associative chains linking the stimulus and response units of the respective pairs. (d) The free-association norms are "critical" in defining these associative chains. (e) Russell and Storms' (1955) results are reproducible and of considerable generality even though the facilitation produced by mediation does not result in absolute positive transfer.

54. McNulty, J. A. The effects of "instructions to mediate" upon paired-associate learning. *Psychonomic Science*, 1966, 4, 61-62.

Subjects were given two paired-associate lists to learn at either the first, third, or text orders of approximation to English. One-third of Ss at each order received "mediating" instructions between the two lists, another third received "motivating" instructions, and the remainder simply rested. Mediating instructions facilitated second list learning at higher orders of approximation, but the effect was only obtained with relatively unmotivated Ss. When highly motivated Ss were used, there was little difference among the three groups.

55. Mandler, G., & Earhard, B. Pseudomediation: Is chaining an artifact? *Psychonomic Science*, 1964, 1, 247-248.

Mediated association in verbal learning has frequently been characterized by the facilitation produced in a three-stage paired-associate paradigm: A-B, B-C, A-C. Using an appropriate control group, the present experiment demonstrated facilitation in an A-B, B-C, A-E paradigm. It is argued that the usual mediation effect may be not due to mediated chaining but rather to a combination of bidirectional association and unlearning.

56. Marchbanks, G., & Levin, H. Cues by which children recognize words. *Journal of Educational Psychology*, 1965, 56(2), 57-61.

To discover the bases on which children recognize words, 50 kindergarten and 50 1st-grade children were required to select from a group of pseudowords, the 1 similar to a word that had just been exposed to them. Each word in the response group contained 1 cue that was the same as the stimulus word, with the other cues held constant. Specific letters, and not the overall shape of the words, form the basis for recognition. The 1st letter is the most important cue; the final letter is the 2nd most important. In 3-letter words the last letter is a more salient cue than in 5-letter words.

57. Margrain, S. A. Short-term memory as a function of input modality. *Quarterly Journal of Experimental Psychology*, 1967, 19, 109-114.

The two experiments reported are concerned with short-term memory for digit lists simultaneously presented both auditorily and visually. Results showed (1) that interpolated written and verbal recall differentially affect retention depending on whether the to-be-recalled list was presented auditorily or visually. (2) That input modality appears to be far more important for recall than was directing subjects' attention to a list during input, when that list might or might not have been subsequently required for recall. The results suggest that short-term storage is modality specific. In this case, Broadbent's P and S mechanisms do not adequately describe what happens during simultaneous visual and auditory presentation. Nor would Sperling's suggestion of a final auditory store appear to be supported.

58. Markel, N. N., & Hamp, E. P. Connotative meanings of certain phoneme sequences. *Studies in Linguistics*, 1960-1, 15, 47-61.

Several 'cultural' connotative meanings are established for five consonant clusters that occur in English: gl-, sp-, fl-, sm-, and st-. The instrument used to obtain responses was the semantic differential, and a t-test was used to obtain the level of significance of the differences between test items for each of

fifteen adjective-pair rating scales for 48 subjects. Impressionistic expectations were confirmed as to the 'strength' of the connotative meaning of the consonant clusters. The authors propose that the psycho-linguistic unit so disclosed be called a psychomorph: a non-morphemic unit of one or more phonemes for which a cultural meaning can be established. The lack of constancy of these units was noted, their fluctuation in meaning, or lack of meaning, being a function of their (morpho)phonemic environment in the utterance. These units and such meanings have important implications with respect to morphemic theory.

59. Marks, L. E., & Miller, G. A. The role of semantic and syntactic constraints in the memorization of English sentences. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 1-5.

Ninety-six Ss learned normal sentences, anomalous sentences, anagram strings, and word-lists for five trials by the method of free recall. The results demonstrate a differentiation between semantic and syntactic factors and a facilitory effect of both on learning.

60. Martin, E. Stimulus pronunciability in aural paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 18-22.

An experiment was conducted in an attempt to assess the merits of a stimulus availability interpretation of stimulus pronunciability (PR) effects in aural paired-associate learning. Stimulus PR was varied within lists of 8 trigram-adjective pairs. The study-test technique was used. The intra-SR interval of study trials was either 2, 4, or 6 sec, thus allowing periods of different length in which to manipulate stimulus availability at the time of the response event. Subgroups of Ss either counted backwardly during this interval, repeated the stimulus aloud, or were left uninstructed. Stimulus recall was given at the end of learning without forewarning.

The results indicate that stimulus repetition efficiently serves to maintain availability over the intra-SR interval. Counting backwardly during this interval, however, markedly impedes acquisition, but not differentially from the stimulus-repetition condition over levels of PR as would be expected from short-term retention studies involving pronunciability as a variable. The failure of the three intra-SR activities to interact over levels of PR both during acquisition and in post-acquisition stimulus recall makes differential availability (in the sense of recallability) according to PR an untenable explanation of stimulus-PR effects.

61. Mehler, J. Some effects of grammatical transformations on the recall of English sentences. *Journal of Verbal Learning and Verbal Behavior*, 1963, 2, 346-351.

The recall of English sentences varying systematically in syntactic structure was studied by the method of prompted recall with 80 Ss. Analysis of the errors indicated that most of them were due to syntactical confusions. The hypothesis is advanced that Ss analyze the sentences into a semantic component plus syntactic corrections when they learn them, and that this separation of semantic content from syntactic form is one reason that the general meaning of a message is generally so much easier to recall than its exact wording.

62. Melamed, L. E. The role of response processes in the formation of cross-modality assimilation effects. *Perception and Psychophysics*, 1970, 8(3), 185-188.

The enhanced judgments of intensity of soft tones judged along with a series of bright lights (assimilation effect) was found to be dependent on the fact that the lights were judged coincidently. This dependence was not observed in a parallel investigation of contrast effects in the judgments of tones alone. Both the form of the assimilation effect and its specific dependence on judging both stimulus modalities argues against a sensory explanation. Instead, it is argued that this cross-modality assimilation effect represents a resolution of the specific difficulties involved in judging two qualitatively different modalities on one judgment scale.

63. Miller, G. A., & Selfridge, J. A. Verbal context and the recall of meaningful material. *American Journal of Psychology*, 1953, 63, 176-185.

A quantitative definition for verbal context is given in terms of dependent probabilities. The definition is used to construct lists of words with varying degrees of contextual determination. When short range contextual dependencies are preserved in nonsense material, the nonsense is as readily recalled as is meaningful material. From this result it is argued that contextual dependencies extending over five or six words permit positive transfer, and that it is these familiar dependencies, rather than the meaning per se, that facilitate learning.

64. Muehl, S. The effects of visual discrimination pretraining on learning to read a vocabulary list in kindergarten children. *Journal of Educational Psychology*, 1960, 51(4), 217-221.

This experiment compared the performance of three groups of kindergarten children in learning to read a vocabulary list. The groups differed in their pretraining experience. Group S learned to match the same words that appeared in the vocabulary list; Group D matched different words; and Group F matched geometric forms.

The response measure was the number of correct anticipations in 12 trials of the vocabulary learning list. Analysis of the data showed that Group S performed significantly better than Groups D and F. The difference between Groups D and F was not significant.

The results suggest that word recognition skill is related to the development of specific visual discrimination skills. The results also agreed with the findings of previous psychological research in stimulus differentiation pretraining.

65. Nelson, T. O. Spelling-pronunciation integration: Determinant of bimodal recall. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 118-122.

A within-S design was used to investigate three parameters of bimodal recall. The three parameters were: similarity to English pronunciation (PSE), similarity to English spelling (SSE), and the congruence of spelling and pronunciation (SPC). Twenty Ss learned 12 CCVCC syllables which had been classified into four types according to their values on the above parameters. Each S simultaneously saw and heard the syllables, and then recalled them in any order by writing and pronouncing each remembered syllable. PSE, SSE, and SPC were all significant variables ($p < .01$). The percentage of total variance accounted for by each variable was 2.2 (PSE), 10.4 (SSE), and 28.9 (SPC).

66. Nikkel, N., & Palermo, D. S. Effects of mediated associations in paired-associate learning of children. *Journal of Experimental Child Psychology*, 1965, 2, 92-102.

This investigation was conducted to demonstrate that mediated associations can facilitate or impair the performance of children on a verbal paired-associate task. Natural language associates derived from free-association norms in the mediational chain were used in the investigation. Two chaining paradigms were tested: A-B, B-C, A-C and A-B, C-A, C-B. A-B learning was assumed from the normative data for sixth-grade children. Sixty Ss learned by the method of anticipation two lists of S-R pairs constructed such that each S served as his own control for the three experimental conditions: facilitation, interference, and control. The results for both paradigms revealed the facilitation condition to be significantly superior to the interference condition, with the control condition falling between. These results provide support for a theory of mediated association and demonstrate that existing language habits can influence the acquisition of new verbal habits by implementing the mediating process.

67. Nodine, C. F., & Hardt, J. V. Role of letter-position cues in learning to read words. *Journal of Educational Psychology*, 1970, 61(1), 10-15.

Prereading children were required to detect irregularities (transpositions) in letter sequences between pairs of four-letter pseudowords containing middle letters of either high or low confusability (e.g., AMWJ or ZNRQ). The pairs were presented in either a horizontal or vertical presentation format to children of high and low reading readiness levels. Sequential search patterns characteristic of prereaders were facilitated by the vertical format. The use of letter-position cues by prereaders was enhanced by minimizing formal similarity (overlap between letter features) and maximizing the role of experiental factors such as bigram letter frequency.

68. O'Connor, N., & Hermelin, B. Like and cross modality recognition in subnormal children. *Quarterly Journal of Experimental Psychology*, 1961, 13, 48-52.

The ability of mentally subnormal children to recognize previously presented visual or verbal stimuli was compared. In "like-modality" procedures they had to recognize words or pictures in the modality in which they had originally been presented. In "cross-modality" procedures the stimulus they had to recognize was in the opposite modality from that which had been used for the first presentation.

In every recognition test the items had to be recognized from among an equal number of novel stimuli. Cross-modality procedures resulted in higher recognition scores. The hypothesis is advanced that this could be accounted for by the necessary translation from one type of sensory image to another in the cross-modality trials, which might minimize over-generalization.

69. Paivio, A. Abstractness, imagery, and meaningfulness in paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1965, 4, 32-38.

Subjects were given alternate learning trials (auditory presentation of pairs) and recall trials (presentation of stimuli) on a list of paired-associates composed of concrete and abstract nouns. On the assumption that concrete nouns are superior to abstract nouns in their capacity to elicit sensory images, and that imagery can mediate the formation of an associative connection between members of a pair, it was expected that learning would be particularly facilitated with the concrete nouns as stimuli. Thus, the predicted learning difficulty of four stimulus-response combinations was as

follows: concrete-concrete, concrete-abstract, abstract-concrete, and abstract-abstract, in increasing order of difficulty. Analysis of recall scores strongly supported that prediction.

The words were also rated on the ease with which they arouse sensory images. As expected, the concrete nouns were consistently rated higher than abstract nouns on this attribute. Other data indicated that the concrete nouns were also higher in associative meaningfulness and auditory familiarity and that the three measured attributes of the words were substantially correlated. Several possible interpretations of the findings were considered.

70. Paivio, A. Paired-associate learning and free recall of nouns as a function of concreteness, specificity, imagery, and meaningfulness. *Psychological Reports*, 1967, 20, 239-245.

Abstractness-concreteness and generality-specificity of words were simultaneously varied in a factorial design on the stimulus and response sides of paired-associate lists constructed from 96 nouns. The analysis of recall scores from the auditory presentation of 2 alternating study trials and recall trials revealed significant ($p < .001$) effects of both variables on the stimulus side of pairs. A smaller effect on the response side was significant ($p < .05$) only in the case of specificity. A second experiment showed positive effects ($p < .001$) of both concreteness and specificity on free recall. Mean scores were also available for the nouns on their rated capacity to evoke sensory images (I) and on their meaningfulness (m). A correlational analysis indicated that, of the attributes involved, I correlated most highly with learning scores. Furthermore, consistent with the hypothesis that stimulus-evoked imagery can mediate response recall, the superiority of I was greatest when the items served as stimulus terms in PA learning.

71. Paivio, A., Yuille, J. C., & Smythe, P. C. Stimulus and response abstractness, imagery, and meaningfulness, and reported mediators in paired-associate learning. *Canadian Journal of Psychology*, 1966, 20(4), 362-377.

Three experiments were conducted to differentiate the effects of word concreteness, image-evoking capacity, and meaningfulness (m) on paired-associate (PA) learning of nouns. In each experiment, within the limits imposed by positive correlation among the variables, one attribute was systematically varied among stimulus and response members of a 16-pair list while maintaining within-pair constancy on the other two attributes. The results indicated that concreteness and imagery were both more effective on the stimulus than response side of pairs, suggesting a common underlying process. Meaningfulness, m, was equally effective on both sides of pairs when varied among abstract nouns, but had essentially no effect when the nouns were concrete.

The relations among item attributes, type of mediator, and learning were also investigated. Following the PA experiment, Ss indicated whether they had used a verbal mediator, a "mental image," or no mediatory to associate the members of each pair. In support of predictions, imaginal mediators were most frequently reported for concrete-noun pairs and for pairs in which both members are individually high in rated imagery. Conversely, reports of verbal mediation predominated in the case of abstract-noun pairs, particularly those that were also high m. Further analyses indicated that learning scores were highest for pairs reportedly learned with the aid of mediating imagery, intermediate for verbally mediated pairs, and lowest for non-mediated pairs. The apparent effectiveness of verbal and imaginal mediators also varied with item attributes, although causal relations could not be inferred unequivocally from these data.

72. Pash, J. R., & Blick, K. A. The effect of a mnemonic device on retention of verbal material. *Psychonomic Science*, 1970, 19(4), 203-204.

After 48 h, the retention of two lists of nine words, one list containing high meaningful words, the other low meaningful words, was compared for a group that was instructed in the use of a mnemonic device and a group that received no such instruction. The mnemonic group was instructed that the initial letters of the nine words could be arranged to spell the word "education." Overall, the high meaningful list gave superior retention, and Ss who employed the mnemonic device showed superior retention, but the general method effect was not significant.

73. Peterson, M. J., & Blattner, K. C. Development of a verbal mediator. *Journal of Experimental Psychology*, 1963, 66(1), 72-77.

To investigate the acquisition of a single mediating association 1 paired associate (A-B) was presented, followed by a 2nd paired associate (B-C). On the test trial, S selected the response that seemed "right" to pair with Stimulus A from 3 response alternatives, including the C response. An extraneous syllable was substituted for B in the control conditions. The number of presentations of the establishing stages (1, 3, or 6) and the meaningfulness of the learning materials were varied. Responses reflecting mediational associations and an availability effect were observed. Mediational responses increased as the meaningfulness of the learning materials increased. The number of presentations of the establishing stages influenced the availability of C but not the mediational responding, per se.

74. Peterson, M. J., Colavita, F. B., Sheahan, D. B., III, & Blattner, K. C. Verbal mediating chains and response availability as a function of the acquisition paradigm. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 11-18.

Eight mediation paradigms were evaluated by comparing test-trial responses following mediation presentation with test-trial responses following control presentation. CCCs of low association value were used as the learning materials in one experiment, and CVCs of 100% association value in a second experiment. Response-equivalence paradigms and one stimulus-equivalence paradigm yielded mediated facilitation with both types of learning materials. When CVCs were used, two chaining models also showed mediated facilitation. Forward associations and minimal temporal separation of the A and C items, as they probably existed implicitly and explicitly during the second acquisition stage, led to mediated facilitation only when CCCs were the learning materials. With more meaningful materials these two variables were considerably less potent.

Two additional experiments were performed to replicate the results of Paradigm II, which yielded negative results in Exp. I and positive results in Exp. II. The data corroborated the earlier conclusions that mediated facilitation was more likely to be observed with learning materials of higher meaningfulness.

Selection of C as the test-trial alternative which made the "best pair" with the stimulus were reliably above an a priori chance level for all paradigms. In addition, the eight paradigms showed significant differences in this factor (response availability) which seemed to be predictable from the temporal interval separating presentation of C in the acquisition stages and its appearance of a test-trial alternative.

75. Pimsleur, P., Sundland, D. M., Bonkowski, R. J., & Mosberg, L. Further study of the transfer of verbal materials across sense modalities. *Journal of Educational Psychology*, 1964, 55(2), 96-102.

In a previous study Ss learned paired associates (e.g., Polef-Green) more rapidly when they were 1st presented aurally then visually (A-V) than in the opposite order. In this study 1/2 the nonsense words were low discrepancy (spelled and pronounced alike by most Americans), and 1/2 were high discrepancy (e.g., Wint pronounced [vint], as in German). Ss were 32 college students. The dependent variable was number of errors in 7 trials. The better Ss made fewer errors in the V-A presentation; poorer Ss made fewer errors in A-V presentation. Neither finding was significant when the experiment was repeated, using new materials, 2 wk. later. It was concluded that A-V order is approximately equal to V-A in facilitating learning.

76. Postman, P., Keppel, G., & Zacks, R. Studies of learning to learn: VII. The effects of practice on response integration. *Journal of Verbal Learning and Verbal Behavior*, 1968, 7, 776-784.

This study investigated the acquisition of skills in response integration during the learning of lists with unfamiliar response terms. In the four experimental treatments Ss learned two successive lists of paired associates with numbers as stimuli and trigrams as responses. The two lists conformed to the A-B, C-D paradigm. The response terms were of either high (H) or low (L) meaningfulness. The four possible combinations of response-term meaningfulness in List 1 and List 2 were used: H-H, L-H, L-L, H-L. The control groups learned the same second lists as the experimental groups. In the first list of the control groups highly available English words (names of the days of the week) were the responses. Experimental and control Ss were yoked in the first-list phase of the procedure for purposes of equating the number of practice trials. The second list was learned significantly faster by the experimental than by the control groups. This difference in general transfer was obtained in the acquisition of both H and L lists. Prior L-list training tended to be more effective than prior H-list training but the differential effects of first-list meaningfulness were relatively small and confined to early transfer trials. The differences between the experimental and control groups failed to show an interaction of first-list and second-list meaningfulness. The results provide evidence for the acquisition of learning skills specific to a circumscribed class of materials. It is likely that these skills facilitate both the integration and association of novel responses.

77. Postman, L., & Rosenzweig, M. R. Practice and transfer in the visual and auditory recognition of verbal stimuli. *American Journal of Psychology*, 1956, 69, 209-226.

This experiment investigates the effects of preliminary training on the visual and auditory discrimination of verbal stimuli. A series of nonsense-syllables was selected for initial ease of visual and auditory discrimination. Different syllables were then given varying frequencies of exercise, ranging from 0 to 15 repetitions. Half the Ss received visual training; the other half were given auditory training. Following the training, recognition was tested. The test-series included the experimental syllables as well as English words. For half the Ss trained visually, the recognition-test was visual, while for the other half the test was auditory. Similarly, auditory training was followed either by a visual or by an auditory test. For visual recognition, the test-items were presented tachistoscopically under different intensities of illumination. For the auditory test, the items were presented in conjunction with different degrees of masking noise.

Frequency of past exercise was found to be a significant determinant of both visual and auditory recognition. The effects were more clear-cut in auditory than in visual discrimination. When the same sense-modality was involved in both training and test, the effects of practice were more pronounced than when there was a change in modality. The transfer-effects from visual training to auditory discrimination were more pronounced than conversely. The analysis of results stressed the reduction of alternative responses produced by the preliminary training. Auditory stimulation tended to produce more complete responses than did visual stimulation. The auditory test was more sensitive than the visual test to the reduction in the number of alternative responses resulting from the preliminary training.

78. Postman, L., & Schwartz, M. Studies of learning to learn. I. Transfer as a function of method of practice and class of verbal materials. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 37-49.

This study investigated interlist transfer as a function of the method of practice and the class of verbal materials used in successive tasks. Each of eight groups learned a training list (List 1) and a test list (List 2). Four kinds of tasks were used for List 1: paired-associate adjectives, serial adjectives, paired-associate trigrams, and serial trigrams. List 2 consisted either of paired adjectives or serial adjectives. All combinations of first and second tasks were used. Intralist and interlist similarity were minimized throughout.

All conditions of training produced substantial improvements in performance on List 2 as compared with first-list learning of the same task. In addition, transfer effects specific to the conditions of prior learning were demonstrated. Such differential transfer effects were more extensive in the acquisition of the paired-associate than the serial test list. The method of practice used in the first task consistently influenced subsequent learning more than did the class of verbal materials. The results support the conclusion that interlist practice effects are based in part on specific instrumental habits which are carried over from one task to the next.

79. Price, L. E. Learning and performance in a verbal paired-associate task with preschool children. *Psychological Reports*, 1963, 12, 847-850.

The aims of the present investigation were to explore the hypothesis that a short anticipation interval in verbal paired-associate learning affects performance rather than learning and

to design a procedure suitable for preschool-age children. One group of Ss received practice on a paired-associate list with a short anticipation interval while another group learned the same list with a longer anticipation interval. When the interval of the former group was increased, they performed as well as the latter group. The results suggest that the number of trials administered in a verbal paired-associate task is a better measure of learning than S's level of performance.

80. Reese, H. W. Imagery in children's paired-associate learning. *Journal of Experimental Child Psychology*, 1970, 9, 174-178.

An earlier study of verbal context and imagery (verbal and pictorial representation of interactions between stimulus and response items) was replicated with a more adequate control condition, and with a 2-week retention test requiring relearning. The verbal-context and imagery effects were again reliable, but an expected age difference was not obtained in that the imagery condition was equally effective in younger and older preschoolers. The treatment differences in retention and relearning were the same as in original learning (although not significant in retention).

81. Rohwer, W. D., Jr. Constraint, syntax and meaning in paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1966, 5, 541-547.

The phenomenon of sentential facilitation of paired-associate learning was investigated by dividing 224 sixth-grade Ss into 14 groups according to the character of verbal pretraining provided. Subjects were given pretraining that consisted of pre-exposure to verbal strings, each of which contained one of the eight pairs of nouns to be learned. Three properties of these verbal strings were manipulated: Meaningfulness, Syntactic Structure, and Constraint.

Pre-exposure to verbal strings facilitated the learning of paired associates only when the strings were characterized by both meaningfulness and syntactic structure. The experiment also produced empirical support for the notion of constraint. A continuum of facilitation was detected, in which verbs produced the greatest facilitation, prepositions a median amount, and conjunctions the least.

82. Ryan, S. M., Hegion, A. G., & Flavell, J. H. Nonverbal mnemonic mediation in preschool children. *Child Development*, 1970, 41, 539-550.

Children of 3-0 to 5-6 years of age were given a task which assessed their ability to make use of an external, ikonic-representational form of memory store (photographs of animals) in retaining the spatial locations of a series of objects (plastic figurines of these same animals). Contrary to the evidence from a previous developmental study of nonverbal, ikonic mediation, the present data suggest that many children as young as 3-6 to 4-0 years of age appear to possess at least the rudiments of this ability. Congruent with previous research, production deficiencies and inefficiencies were much more common than mediation deficiencies and inefficiencies in the child's presolution efforts.

83. Samuels, S. J., & Jeffrey, W. E. Discriminability of words, and letter cues used in learning to read. *Journal of Educational Psychology*, 1966, 57(6), 337-340.

The 36 kindergarten Ss were distributed among 3 groups. Using the paired-associate anticipation method, each group was taught 1 of 3 lists of words that differed in discriminability. Discriminability was determined by the number of different letters (either 4, 6, or 8) used to construct 4 2-letter words. It was hypothesized that the more discriminable the list, the faster the learning rate but the greater the probability that Ss would learn on the basis of single letters. The hypothesis concerning learning rate was confirmed with $p < .01$. After the 4- and 8-letter groups were brought to the same criterion, the 8-letter group was found to identify words on the basis of single letter cues significantly more often ($p < .02$) than the 4-letter group, thus confirming the 2nd hypothesis as well.

84. Schaub, G. R., & Lindley, R. H. Effects of subject-generated recoding cues on short-term memory. *Journal of Experimental Psychology*, 1964, 68(2), 171-175.

Associations to 36 high-meaningfulness (HM) trigrams and to 36 low-meaningfulness (LM) trigrams were collected from a group of men and women college students (N = 20). Another similar group (N = 24) was tested in a short-term memory (STM) study using the Peterson and Peterson (1959) technique. In STM a 2 x 3 x 4 factorial design was used; trigrams were either of HM or LM,

retention intervals were 18, 14, or 20 sec., and the trigrams were presented once or twice or they were preceded by a frequently occurring or infrequently occurring association (as determined in the association test with the 20 Ss). Results were that associations to the HM trigrams as compared to the LM trigrams had shorter latencies ($p < .001$), more 1-word associations, and more letter sequences in common between the association and the trigram. In STM the HM trigrams were recalled better than the LM trigrams ($p < .01$), 2 presentations of the trigram produced better recall than 1 presentation ($p < .01$). Preceding the trigram by an association produced better recall than either 1 or 2 presentations of trigram ($p < .01$), and frequently occurring associations produced better recall than infrequently occurring associations only for LM trigrams ($p < .05$).

85. Schulz, R. W., & Lovelace, E. A. Meaningfulness and the associative phase of paired-associate learning: A methodological consideration. *Psychonomic Science*, 1964, 1, 37-38.

This study shows that Ss who are attempting to locate a given CVC trigram among 10 other trigrams take significantly longer to do so with trigrams of low than with trigrams of high meaningfulness. The implications of this finding for the use of multiple-choice paired-associate task in determining the effects of meaningfulness on the associative phase are discussed.

86. Silverman, I. W., & Craig, J. G. Mediational performance as affected by overt verbalization during training and testing. *Child Development*, 1969, 40, 295-305.

The verbal mediation of an instrumental response in a 3-phase paradigm was studied with kindergarten and second-grade children. The results demonstrated that the kindergarten children were fully capable of mediating their motor responses but did not mediate unless required to verbalize the potential mediators during motor training. The second-grade children mediated whether or not they were instructed to verbalize during motor training. Little or no additional advantage was derived by children at either grade level from overt verbalization during the test phase. The results, together with those of related investigations, were discussed in relation to studies showing that young children are deficient in mediation.

87. Smith, K. H. Mediation and position learning in the recall of structured letter pairs. *Psychonomic Science*, 1965, 2, 293-294.

In recalling a set of 12 structured letter pairs having either MN or PQ structure (where capital letters indicate a class of specific letters), Ss produced more intrusions of the types MQ and PN than expected by chance. This result appears to be contrary to the mediation theory of Jenkins and Palermo (1964) and is somewhat more consistent with Braine's (1963) theory of position learning.

88. Smith, K. H. Grammatical intrusions in the recall of structured letter pairs: Mediated transfer or position learning? *Journal of Experimental Psychology*, 1966, 72(4), 580-588.

Sets of letter pairs were constructed from 4 classes of letters, M, N, P, and Q to form MN and PQ sequences. In free recall, Ss produced more intrusions of the form MQ and PN than would be expected if intrusions were produced by randomly combining the letters appearing in the presented pairs. An adequate account of the intrusion data is provided by a theory of position learning proposed by Braine. An alternative proposal by Jenkins and Palermo (1964) based upon mediated transfer fails to predict the high proportion of MQ and PN intrusions.

89. Smith, W. M. Visual recognition: Facilitation of seeing by hearing. *Psychonomic Science*, 1965, 2, 157-158.

A previous finding of enhanced visual recognition through vocalization by S is confirmed and extended by the present experiment which shows that similar effects on visual recognition occur when a voice other than S's is employed. It is concluded that such facilitation of visual recognition is the result of perceptual interaction not kinesthetic or auditory feedback, as such, nor factors of expectancy and set.

90. Torrey, J. W. The learning of grammatical patterns. *Journal of Verbal Learning and Verbal Behavior*, 1969, 8, 360-368.

The possibility of learning grammatical sequence patterns independently of any associations between particular words is demonstrated through the use of substitution drills. Sixteen Ss were drilled extensively in producing simple Russian sentences of three different patterns. Sixteen control Ss were given explicit grammatical rules followed by equal training on the same set of words, learned separately. The Ss trained with the pattern drills were faster and more accurate in producing, completing, and

remembering Russian sentences than were control Ss, although the test sentences contained none of the same sequences of particular words that had occurred in the pattern drill training. A third group of sixteen Ss, trained by a combination of the two methods, performed better than control Ss but not as well as drill Ss. The results are not easily interpreted in terms of associations or of consciously learned rules.

91. Underwood, B. J. False recognition produced by implicit verbal responses. *Journal of Experimental Psychology*, 1965, 70(1), 122-129.

Two hundred words were read to 100 Ss at a 10-sec. rate. For each word S decided whether it had or had not been read earlier. Critical stimulus words were inserted in the list, these words being presumed to elicit specified implicit responses. Later in the list the assumed implicit response words were presented. For these latter words for 3 of 5 classes of words, false recognition was much higher than for control words. The greater the prior frequency of elicitation of the implicit response the greater the likelihood of false recognition.

92. Underwood, B. J., & Erlebacher, A. H. Studies of coding in verbal learning. *Psychological Monographs*, 1965, 79(13, Whole No. 606), 1-25.

Six experiments are reported in which free learning (FL) and paired-associate learning (PAL) were examined with respect to the effects of coding of verbal units on learning. In 2 FL experiments and 1 PAL experiment where response terms were manipulated, encoding of trigrams to words produced a more meaningful unit. Such encoding was shown to influence learning positively only if decoding was simple. Encoding of a stimulus term to a word was also shown to influence learning positively, but such encoding did not occur unless the possibilities were easily perceived. Finally, an experiment demonstrated sound coding of response terms, but the positive effect on transfer was small and limited to unmixed lists. We concluded that coding systems: (a) may influence learning positively if decoding is simple; (b) will produce only a small positive effect even under favorable conditions; (c) may have no positive effect even if used and may, under certain conditions, inhibit learning.

93. Underwood, B. J., & Keppel, G. Coding processes in verbal learning. *Journal of Verbal Learning and Verbal Behavior*, 1963, 1, 250-257.

In a free learning situation Ss were presented 10 trigrams for five alternate study and recall trials. Each trigram could be

transformed into either of two words by rearranging the letters. Parallel groups were either instructed or not instructed concerning the transformation possibilities. Within these parallel groups, subgroups of 30 Ss each were differentiated on the basis of the nature of the correct response allowed. If Ss were allowed to write the letters of each trigram in any order they wished, performance was facilitated if the trigrams were encoded to words. This facilitation was more apparent in the instructed group than in the noninstructed group simply because more Ss encoded in the former group. If S was required to write down the trigram as presented, encoding to words and decoding to trigrams inhibited performance, but if during learning the rules were changed so that S could write the letters in any order (eliminating decoding) performance rose sharply and to a higher level than that shown by Ss not using an encoding-decoding sequence.

94. Underwood, B. J., Runquist, W. N., & Schulz, R. W. Response learning in paired-associate lists as a function of intralist similarity. *Journal of Experimental Psychology*, 1959, 58(1), 70-78.

Verbal learning may be conceptualized as a two-stage process. In the first phase S must learn the responses, in the second he must attach them to specific stimuli. The present experiments dealt directly with the first stage only. It was hypothesized that: (a) response learning is initially more rapid the higher the response similarity in a paired-associate list; and (b) teaching S the responses before he learns a paired-associate list would initially facilitate the learning of this list.

Two paired-associate lists were used. The stimuli for both lists were nonsense syllables, the responses, adjectives. In one list the adjectives were all similar in meaning, in the other, dissimilar. In one set of conditions (control), Ss merely learned the paired-associate lists by standard procedures for 15 trials. In a second set of conditions, Ss were taught the responses prior to learning the paired-associate list for 15 trials. In the third set of conditions standard paired-associate learning was used but different groups of Ss were stopped after 1, 2, 3, 5, 8, and 13 trials and were asked to write down all the responses they could remember. These three sets of conditions required 16 groups of Ss. There were 20 in each group, all naive to verbal learning experiments.

The results show that:

(a) Teaching S the responses prior to paired-associate learning facilitates the learning of lists with both high and low similarity among the responses. A second experiment showed that this effect cannot be ascribed to warm-up

or learning-to-learn resulting from the procedure of teaching S the responses before paired-associate learning. In both experiments the positive effect was evident throughout the entire 15 trials for lists of high response similarity. For low similarity the effect was only in initial learning for one comparision but present throughout learning in the other.

(b) In response learning (prior to paired-associate learning) items with high similarity are learned initially more rapidly than are items of low similarity, although for both lists learning was very rapid. When Ss are tested for free recall at various points in learning a paired-associate list, more responses are given from a high-similarity list than from a low-similarity list even though over-all level of paired-associate learning is higher for the low-similarity list. The difference in this response recall was clearly evident for the first few trials.

The results confirm the expectation that high intralist response similarity would facilitate response learning. Thus, the results are consistent with the two-stage conception of learning. Furthermore, the present results aid in understanding certain previous findings on the roles of stimulus similarity and response similarity in verbal learning.

95. Warren, D. H. Intermodality interactions in spatial localization. *Cognitive Psychology*, 1970, 1, 114-133.

Adults localize unseen auditory targets better with their eyes open than closed. This visual facilitation phenomenon was studied to provide information about intermodality organization. The necessary condition for facilitation is the presence of structured visual input. While vision facilitates the pointing response to auditory targets, auditory acuity is improved to a greater extent. Results were interpreted in terms of a visual mapping of auditory stimuli. Developmental work showed that children through sixth grade do not show visual facilitation effects.

96. Weissglass, R. R. The effect of memory span on cue patterns in word recognition. Technical Report No. 16, 1966, Research and Development Center for Learning and Re-education, Madison, Wisconsin.

Kindergarten children were used as subjects in an attempt to discover whether children with short and long memory spans use different cues to recognize words, and whether memory span tests

are effective predictors of difficulty in learning to read. It was further hoped that children would exhibit a consistent pattern of choices over trials, which might have implications for teaching word recognition and other reading skills.

The WISC Digit Span Subtest, which measured memory span, was used as the screening device, and 5-letter nonsense words comprised the word recognition task. Children were required to select from a group of nonsense words the one similar to the word that had just been shown to them. Each word in the response group contained one cue which appeared in the same position as in the stimulus word, with the other cues held constant. Five cues were examined--positions 1, 2, 3, 4, and 5--and each subject had an equal opportunity to respond to each cue.

All groups showed a preference for Cue 1 and there was a tendency to respond to Cue 3 and Cue 5. An avoidance effect seemed to be operating with Cue 2 and Cue 4. Results on Friedman's Analysis of Variance of Ranks indicated that random selection may have been operating for boys and girls in the low memory span group, while for the middle and high memory span boys a preference pattern was not likely to arise by chance.

97. Wickelgren, W. A. Similarity and intrusions in short-term memory for consonant-vowel digrams. *Quarterly Journal of Experimental Psychology*, 1965, 17, 241-246.

Subjects listened to lists of six consonant-vowel digrams presented at the rate of 0.8 sec./digram and copied them as they were being presented. Immediately after finishing copying the list, they attempted ordered recall of the six digrams. The digrams in each list were chosen from a population of eight digrams consisting of all digrams that can be constructed from the consonants "f" and "n," the vowels "ā" and "ō," and the two orders "CV" and "VC." Intrusions tended to be similar to the presented digram, and the frequency of an intrusion was a monotonic increasing function of degree of similarity to the presented digram. The ordering of intrusion frequency for each similarity type was from greatest to least: + - + (same consonant, different vowel, same order), + + -, - + +, - + -, + - -, - - +, - - -. The findings indicate that forgetting is not all-or-none, that digrams are coded in terms of phonemes, and that initial vs. terminal position is a distinctive feature of consonants, but not vowels, in short-term memory.

98. Wickelgren, W. A. Distinctive features and errors in short-term memory for English vowels. *Journal of the Acoustical Society of America*, 1965, 38, 583-588. (a)

Errors in short-term recall of six English vowels (ɪ, ɛ, æ, ʊ, ʌ, ɑ) were tabulated and related to several distinctive-feature systems. Vowels were embedded in two contexts: /ɪ[ ]k/ and /z[ ]k/. Subjects were instructed to copy items as they were presented, followed by recall of the entire list of (six) items. Perceptual errors were excluded from the recall error matrix by scoring for recall only correctly copied items. The rank-order frequency of different intrusions in recall of each presented vowel was almost perfectly predicted by a conventional phonetic analysis in two dimensions: place of articulation (front, back) and openness of the vocal tract (narrow, medium, and wide). The error matrix also supported the assumptions that the values of openness are ordered in short-term memory and that the correct value on the openness dimension is more likely to be forgotten than the correct value on the place dimension. The study suggests that a vowel is coded in short-term memory, not as a unit, but as a set of two distinctive features, each of which may be forgotten independently.

99. Wickelgren, W. A. Short-term memory for phonemically similar lists. *American Journal of Psychology*, 1965, 78, 567-574. (b)

In the first experiment 31 Ss attempted ordered recall of two types of 9 letter lists: phonemically similar lists in which all letters had a common vowel phoneme (ā, ē, or ĕ) and phonemically different lists whose letters had no common phoneme. Ordered recall was poorer for similar lists ($p < 0.001$), but this resulted entirely from poorer recall of the position of similar letters ($p < 0.001$). Item-recall, by a free recall criterion, was not significantly different for the two types of lists. In the second experiment 28 Ss attempted ordered recall of the consonants only, from two types of lists of seven consonant-vowel diagrams: phonemically similar lists in which the vowel was identical for all seven diagrams (ā, ē, ī, ō, o͞o͞) and phonemically different lists whose seven vowels were a mixture of the above five vowels. Position-recall was significantly poorer for phonemically similar lists ($p < 0.001$), but item-recall was significantly better for similar lists ($p < 0.001$).

100. Wickens, D. D. Encoding categories of words: An empirical approach to meaning. *Psychological Review*, 1970, 77(1), 1-15.

This article reports a series of studies investigating the dimension along which words are encoded, using the "release from proactive inhibition" in short-term memory technique. The results of the experiments indicate that different dimensions vary in their effectiveness for proactive inhibition release. In general, semantic

dimensions (taxonomic categories or semantic differential) are highly effective, whereas physical characteristics such as word length or figure-ground colors of the slide presentation are relatively ineffective in releasing proactive inhibition. The results of this technique of measuring encoding are related to other types of experiments on verbal material as well as to the topic of subception and imageless thought.

101. Wicklund, D. A., Palermo, D. S., & Jenkins, J. J. The effects of associative strength and response hierarch on paired-associate learning. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 413-420.

Two experiments were designed to assess the influence of free-associative strength on the paired-associate learning of children. In each, three groups of fourth-grade children learned lists of ten verbal paired-associates which varied in average associative strength between the stimulus words and the responses. Group I learned a list composed of stimuli and their primary normative responses, five of which were relatively strong and five of which were relatively weak; Group II learned a list composed of the same ten stimuli and responses which occurred to them with an intermediate normative frequency; and Group III learned a list composed of the stimuli and responses of very low normative frequency.

In Experiment I, ease of learning varied with the average associative strength of the pairs at all levels; and differential performance was obtained on Lists I and II between the pairs with stimuli which elicit relatively high-strength primary responses and those which elicit relatively low-strength primary responses. Performance on the former was better than on the latter. Experiment II differed from Experiment I only in that the Ss had a study trial on the lists before learning trials began. The results essentially paralleled those of Experiment I.

Such findings have not been obtained with adults and were interpreted as representing differences due to natural language habits of differential strengths. The findings with regard to the differential performance on the two types of pairs were discussed as indications that the forced-frequency nature of the single response normative data caused the relative strengths of the responses following high-strength primary responses to be underestimated when based on absolute normative frequencies.

102. Wismer, B., & Lipsitt, L. P. Verbal mediation in paired-associate learning. *Journal of Experimental Psychology*, 1964, 68(5), 441-448.

A verbal paired-associate experiment with 45 fifth-grade children indicated that both facilitation and interference, relative

to performance on control word pairs, can be produced proactively in the same Ss. This was accomplished by administering word pairs in: (a) A-B, B-C, A-C paradigm for facilitation pairs, (b) A-B, B-C, A-C reversed for interference pairs, (c) A-B, X-C, A-C for one type of control, and (d) new word pairs for another type of control. Error analyses revealed that the mechanism underlying the positive and negative transfer was mediational in nature.

103. Yarmey, A. D., O'Neill, B. J., & de Ryk, D. Stimulus and response concreteness, imagery, and temporal factors in paired-associate learning. *Psychonomic Science*, 1968, 13(6), 321-322.

This study investigated the effects of recall rates (2:3-sec vs 2:5-sec vs 2:8-sec), length of between-trial intervals (none vs 10 sec vs 60 sec), and nouns concreteness on paired-associate learning. Ss learned a list of concrete-concrete, concrete-abstract, abstract-concrete, and abstract-abstract nouns. The results indicated that concrete nouns, particularly on the stimulus side of pairs, facilitated recall. Intertrial intervals yielded no significant effect on recall. The failure to find significant differences attributable to recall rates was discussed in reference to a previous study which found differences in learning abstract and concrete noun stimuli as a function of duration of input or study intervals.

104. Yuille, J. C., & Paivio, A. Imagery and verbal mediation instructions in paired-associate learning. *Journal of Experimental Psychology*, 1968, 78(3), 436-441.

This study investigated the effects of mediation instructions and noun concreteness (C) on paired-associate (PA) learning. Ss were given 1 of 3 sets of instructions to learn pairs: to employ imagnal mediators, verbal mediators, or simple repetition. S then practiced his technique with a PA list composed of either concrete or abstract nouns. Subsequent to the practice list, S was given 4 alternating learning and recall trials with 1 of 4 lists. Each list contained 16 pairs of 1 of the combinations of stimulus and response C; i.e., concrete-concrete, concrete-abstract, etc. Concrete nouns, particularly on the stimulus side of pairs, facilitated recall of the learned list. Noun C of the practice list did not affect performance on the learned list. Ss instructed to use repetition showed poorer performance on the 1st 2 trials than Ss instructed to use mediators, and noun C affected the repetition group less on the 1st trial. Contrary to expectations, the imagery and verbal mediators set did not result in recall differences. However, latencies of mediator discovery obtained during the practice period did differ as a function of mediation instructions. These results were considered in terms of alternative interpretations, with the suggestion that imaginal mediators may be more effective than verbal mediators.

105. Yuille, J. C., & Pritchard, S. Noun concreteness and verbal facilitation as factors in imaginal mediation and PA learning in children. *Journal of Experimental Child Psychology*, 1969, 7, 459-466.

An experiment was conducted to study the effects of noun concreteness and type of verbal connective on speed of discovery of imaginal mediators for Grade-2 and Grade-6 children. A second experiment examined the effects of the same variables on paired-associate (PA) learning. In both experiments concreteness had a facilitatory effect, while the type of connective had no apparent effect. A significant negative correlation was found between mediation latencies and PA learning. These findings were interpreted as evidence for mediating imagery being effective in PA learning, particularly with the older group of children.

106. Zuckerman, C. B., Epstein, W., & Rock, I. Meaning and familiarity in associative learning. *Psychological Monographs*, 1960, 74(4, Whole No. 491), 1-22.

The roles of familiarity and meaning in associative learning were investigated.

Experiment I revealed the effect of familiarity: prefamiliarized nonsense syllables were learned better than novel ones.

In Experiment II a group of Ss learned three lists of six pairs of words: a list of nouns, a list of three conjunction pairs and three preposition pairs, and a list of nonsense syllable pairs.

Experiment III was an attempt to localize the influence of meaning and familiarity. Experiment II, therefore, was repeated, this time using matching instead of reproduction to test learning.

Experiment IV was designed to determine whether the advantage of conjunctions and prepositions in Experiments II and III is due to familiarity or to limited meaning.

Experiment V provided evidence relating to the role of sequential probability in our experiments.

In Experiment VI we tested the possibility that meaningful material allows for the formation of conceptualizable units which combine the separate items into a new whole.

In Experiment VIIa we investigated further the hypothesis that the conceptualization of objects is facilitating because it encourages the formation of units.

These experiments were considered in their relation to the explanations offered to account for the role of meaningfulness.

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